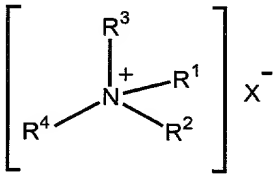
Claims

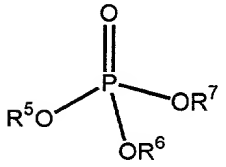
1. A composition, comprising:

a quaternary ammonium compound of formula (I)



(I); and

a phosphate ester of formula (II);



(II);

wherein R^1, R^2, R^3, R^4 are independently a hydrocarbyl group;

X is selected from the group consisting of halide and sulfate; and

R^5, R^6, and R^7 are independently selected from the group consisting of hydrogen, a hydrocarbyl group, and a polyoxyalkylated alcohol.

2. The composition of claim 1, wherein R^1 and R^2 contain from 1 to 6 carbon atoms; and R^3 and R^4 contain from 7 to 20 carbon atoms.

3. The composition of claim 1, wherein R^1 and R^2 contain from 1 to 5 carbon atoms; and R^3 and R^4 contain from 7 to 15 carbon atoms.

4. The composition of claim 1, wherein R^1 and R^2 contain from 1 to 3 carbon atoms; and R^3 and R^4 contain from 8 to 12 carbon atoms.

5. The composition of claim 1, wherein R^1 and R^2 are decyl; and R^3 and R^4 are methyl.

6. The composition of claim 5, wherein X is a halide.

7. The composition of claim 5, wherein X is chloride.

8. The composition of claim 1, wherein R^5 is a polyoxyalkylated alcohol of from 2 to 500 carbon atoms.

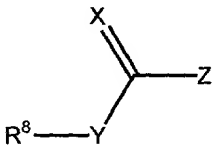
9. The composition of claim 8, wherein the polyoxyalkylated acohol comprises an alcohol portion of from 1 to 20 carbon atoms.

10. The composition of claim 8, wherein the polyoxyalkylated acohol comprises an alcohol portion of from 6 to 14 carbon atoms.

11. The composition of claim 8, wherein R^6 and R^7 are hydrogen.

12. The composition of claim 1, wherein the phosphate ester is poly(oxy-1,2-ethandiyl) tridecyl hydroxy phosphate.

13. The composition of claim 1, further comprising a thiocarbonyl compound of formula (III)



(III);

wherein R^8 is selected from the group consisting of metal ion, ammonium ion, hydrocarbyl, and heterohydrocarbyl;

X and Y are independently selected from the group consisting of oxygen and sulfur;

Z is selected from the group consisting of OR^9 and $NR^{10}R^{11}$; and

R^9, R^{10}, and R^{11} are independently selected from the group consisting of hydrocarbyl and heterohydrocarbyl.

14. The composition of claim 13, wherein X is sulfur.

15. The composition of claim 14, wherein Z is $NR^{10}R^{11}$.

16. The composition of claim 15, wherein R^{10} and R^{11} are independently hydrocarbyl groups of from 1 to 10 carbon atoms.

17. The composition of claim 15, wherein R^{10} and R^{11} are independently hydrocarbyl groups of from 1 to 5 carbon atoms.

18. The composition of claim 16, wherein Y is sulfur.

19. The composition of claim 18, wherein R^8 is a metal ion.

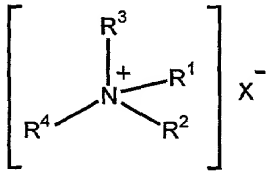
20. The composition of claim 13, wherein the thiocarbonyl compound is potassium dimethyl dithiocarbamate.

21. The composition of claim 1, further comprising a solvent.

22. The composition of claim 1, further comprising at least one additive selected from the group consisting of a supplemental corrosion inhibitor, a scale inhibitor, a sufactant, a biocide, a foamer, and an oxygen scavenger.

23. A composition, comprising:

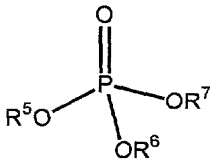
a quaternary ammonium compound of formula (I)



(I);

wherein R^1, R^2, R^3, R^4 are independently a hydrocarbyl group;

a phosphate ester of formula (II);

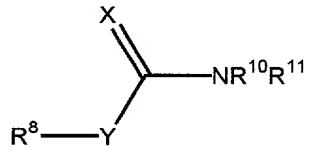


(II);

wherein X is selected from the group consisting of halide and sulfate; and

R^5, R^6, and R^7 are independently selected from the group consisting of hydrogen, a hydrocarbyl group, and a polyoxyalkylated alcohol; and

a thiocarbonyl compound of formula (III);



(III);

wherein R^8 is selected from the group consisting of metal ion, ammonium ion, hydrocarbyl, and heterohydrocarbyl;

X and Y are selected from the group consisting of oxygen and sulfur, such that at least one of X and Y is sulfur; and

R^{10} and R^{11} are independently selected from the group consisting of hydrocarbyl and heterohydrocarbyl.

24. The composition of claim 23, wherein

R^1 and R^2 are independently a hydrocarbyl group of from 1 to 6 carbon atoms;

R^3 and R^4 are independently a hydrocarbyl group of from 7 to 20 carbon atoms;

R^5 is a polyoxyalkylated alcohol of from 2 to 500 carbon atoms;

R^6 and R^7 are independently hydrogen or a hydrocarbyl group of from 1 to 20 carbon atoms;

X is sulfur; and

R^{10} and R^{11} are independently hydrocarbyl groups of from 1 to 10 carbon atoms.

25. The composition of claim 23, wherein the quaternary ammonium compound is didecyl dimethyl ammonium chloride; the phosphate ester is poly(oxy-1,2-ethandiyl) tridecyl hydroxy phosphate; and the thiocarbonyl compound is potassium dimethyl dithiocarbamate.

26. The composition of claim 23, further comprising a solvent.

27. The composition of claim 26, further comprising at least one additive selected from the group consisting of a supplemental corrosion inhibitor, a scale inhibitor, a sufactant, a biocide, a foamer, and an oxygen scavenger.

28. The composition of claim 27, wherein
the quaternary ammonium compound is present at 1-95% by weight;
the phosphate ester is present at 0-95% by weight;
the thiocarbonyl compound is present at 0-95% by weight;
the solvent is present at 5-95% by weight; and
the at least one additive is present at 0-95% by weight.

29. The composition of claim 27, wherein
the quaternary ammonium compound is present at 1-50% by weight;
the phosphate ester is present at 1-50% by weight;
the thiocarbonyl compound is present at 0-50% by weight;
the solvent is present at 20-80% by weight; and
the at least one additive is present at 0-50% by weight.

30. The composition of claim 27, wherein
the quaternary ammonium compound is present at 1-20% by weight;
the phosphate ester is present at 1-20% by weight;
the thiocarbonyl compound is present at 1-20% by weight;
the solvent is present at 50-75% by weight; and
the at least one additive is present at 0-20% by weight.

31. The composition of claim 27, wherein the quaternary ammonium compound, the phosphate ester, and the thiocarbonyl compound are present at a 1:1:1 ratio by volume.

32. A method of inhibiting corrosion of iron and ferrous base materials, comprising:

contacting a material with the composition of claim 1.

33. A method of inhibiting corrosion of iron and ferrous base materials, comprising:

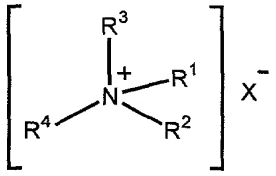
contacting a material with the composition of claim 23.

34. A method of inhibiting corrosion of iron and ferrous base materials, comprising:

contacting a material with the composition of claim 25.

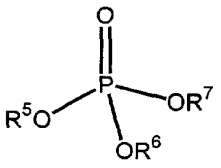
35. A method of making a corrosion inhibitor, comprising

combining a quaternary ammonium compound of formula (I)



(I)

with a phosphate ester of formula (II)



(II);

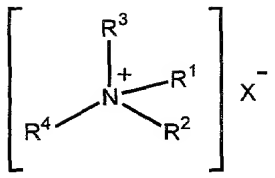
wherein R^1, R^2, R^3, R^4 are independently a hydrocarbyl group;

X is selected from the group consisting of halide and sulfate; and

R^5, R^6, and R^7 are independently selected from the group consisting of hydrogen, a hydrocarbyl group, and a polyoxyalkylated alcohol.

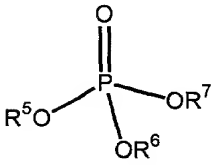
36. A method of making a corrosion inhibitor, comprising

combining a quaternary ammonium compound of formula (I)



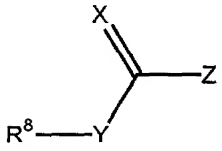
(I)

with a phosphate ester of formula (II)



(II)

and further with a thiocarbonyl compound of formula (III)



(III);

wherein R^8 is selected from the group consisting of metal ion, ammonium ion, hydrocarbyl, and heterohydrocarbyl;

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